

US009408530B2

(12) United States Patent

Ferren et al.

(54) PARAMETER-BASED NAVIGATION BY A LUMEN TRAVELING DEVICE

(75) Inventors: Bran Ferren, Beverly Hills, CA (US);
W. Daniel Hillis, Encino, CA (US);
Roderick A. Hyde, Redmond, WA (US);
Muriel Y. Ishikawa, Livermore, CA
(US); Edward K. Y. Jung, Bellevue, WA
(US); Eric C. Leuthardt, St Louis, MO
(US); Nathan P. Myhrvold, Bellevue,
WA (US); Thomas J. Nugent, Jr.,
Bellevue, WA (US); Elizabeth A.
Sweeney, Seattle, WA (US); Clarence T.
Tegreene, Bellevue, WA (US); Lowell L.
Wood, Jr., Bellevue, WA (US); Victoria
Y. H. Wood, Livermore, CA (US)

(73) Assignee: Gearbox, LLC, Bellevue, WA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: 13/136,680

(22) Filed: Aug. 5, 2011

(65) **Prior Publication Data**

US 2012/0035440 A1 Feb. 9, 2012

Related U.S. Application Data

(60) Continuation-in-part of application No. 11/403,230, filed on Apr. 12, 2006, now Pat. No. 9,011,329, and a continuation-in-part of application No. 11/417,898, filed on May 4, 2006, now Pat. No. 8,353,896, and a

(Continued)

(51) **Int. Cl.**A61B 5/00 (2006.01)

A61B 1/04 (2006.01)

(Continued)

(45) **Date of Patent:**

(10) Patent No.:

US 9,408,530 B2

Aug. 9, 2016

(Continued)

(56) References Cited

U.S. PATENT DOCUMENTS

3,391,697 A 3,802,417 A 7/1968 Greatbatch 4/1974 Lang (Continued)

FOREIGN PATENT DOCUMENTS

CN 99810271.7 10/2001 EP 1 245 201 A1 10/2002 (Continued)

OTHER PUBLICATIONS

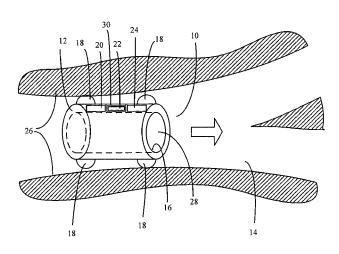
U.S. Appl. No. 12/930,916, Wood, Jr., Lowell. (Continued)

Primary Examiner — Patricia Mallari Assistant Examiner — Karen Toth

(57) ABSTRACT

Methods of controlling the operation of a device traveling in a body tube tree, including sensing parameters from possible directions of travel and selecting the direction of travel based on the sensed parameters, implemented with a control system located partially or fully on the lumen traveling device. Various actions can be performed by the device for, e.g., medical or therapeutic purposes. Machine-readable media including instructions for performing the methods are also described.

17 Claims, 99 Drawing Sheets



(52) U.S. Cl.